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Iron Age II Pithoi from Tall Jāwa, Jordan: Construction Techniques and Typology

In his revolutionary classification of ancient pottery on the basis of its construction techniques, Franken (1982: 141) has opened a window that reveals new approaches to pottery analysis. In his typology, Franken analyzed and attempted to reproduce the manufacturing techniques employed by ancient potters in order to discern their intentions. For Franken, this intention "constitutes the basic criterion of a ceramic typology" (Frendo 1988: 109).

Franken first employed a technological approach in his analysis of the Iron Age I pottery from Dayr 'Allā (1969) where he used the word "type" to mean a specific ceramic vessel shape along with its distinctive construction techniques. For example, Franken distinguished three types of cooking pots on the basis of their "technical characteristics" which included the formation process for the pot as a whole, as well as the techniques used to fold the rim. As far as Franken could tell, all cooking pot bases were made in a mould although some may have been coil built (1969: 129). The shallow open-mouth cooking pots were classified on the basis of rim formation techniques; in Type 1 the rim was folded twice, while in Type 2 the rim was folded once. Type 3 includes round bodied vessels with a variety of rim forms and those with a handle.

In later reflection on his classification system, Franken revised his judgment on what constituted a type and reserved that word to refer to a specific technical formula for the production of various classes of ceramic wares (1982: 142). According to Frendo, such a formula serves as a taxonomic principle (1988: 115). In this system, a wide variety of ceramic vessels serving different functions would fall into the same type if they showed evidence of similar construction techniques. Thus one type might consist of all bowls and jars, whether large or small (Franken 1982: 142). In fact, Franken consolidates all Iron Age I vessels from Dayr 'Allā into four types (1982: 142). These four construction types within one corpus constitute a pottery tradition that can be compared to traditions from other sites and regions.

Within each type, the archaeologist can identify various classes of ceramic vessels depending on the research areas under investigation. Frendo suggests a two-fold classification of analytical categories. The first category involves direct study of the vessels for their physical, technological and stylistic aspects. The second category consists of an indirect analysis of pottery for its anthropological,[1] historical or chronological value (1988: 114).

Following Franken, McGovern organized his corpus of Late Bronze and Early Iron Age pottery from the Baq'ah Valley and Khirbat Umm ad-Danānīr into a stylistic typology supported by a study of the formation processes and physical characteristics of the wares themselves. In his analysis, McGovern has not only identified parallels with the Dayr 'Allā pottery making tradition but has also pointed out unique elements in the Baq'ah Valley corpus (1986: 65, 164).

While a typology based on ceramic formation techniques, comparable to either that of Franken or of McGovern, is not yet possible for the ceramic corpus from Tall Jāwa, and will not be for many years, a preliminary study of the construction techniques employed in the production of Iron Age[2] pithoi is a suitable starting point. This vessel form was chosen for analysis because it constituted the dominant type of large storage jar in use during the last phase of occupation (FPs 5-4) in Field A where these vessels formed part of a food preparation and storage assemblage of artifacts all in use in a single room (Field A13, L. 12,21). The pithoi were found smashed, apparently *in situ*, during the first season of excavations in 1989.[3]

[1] The intended function of a ceramic vessel may also impact on the construction techniques selected by the potter. For a study of the uses of pottery, see Ellison 1984; Henrickson and McDonald 1983; and Rice 1987.

[2] A study of selected pottery from secure loci in Field A suggests that the chronological range falls in the century from 850-750 BC. See Daviau 1991.

[3] The excavations at Tall Jāwa, 10 km south of 'Ammān, were initiated as a sounding of the Madaba Plains Project Hinterland excavation team under the direction of Randall W. Younker. P. M. Michèle Daviau served as Field Director and opened one area, Field A, consisting of five 6 m squares. The excavations recovered evidence for occupation during the Middle Bronze, Iron I, Iron II and Umayyad periods.

Large Jars and Pithoi

For this study, we have analyzed five restored vessels and six partially restored pithoi[4] (TABLE 1). These jars were of plain, undecorated ware with almost-cylindrical bodies that tapered down to a rounded base. Two styles of rim form were employed; Type 1 had thickened inverted rims while Type 2 had thickened upright rims that sprang directly from the shoulder. A double groove marked the base of the rim and a double "string line" marked the shoulder at the level of the handles (FIGS. 1, 2).

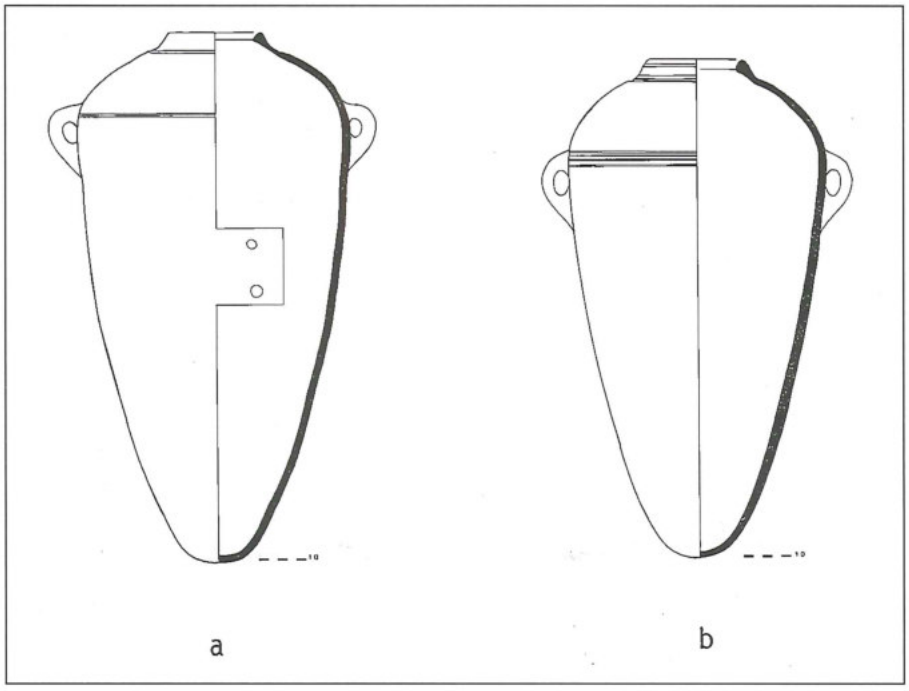
Table 1. Field Phase 5 pithoi: Registration numbers and sizes.

Pithos	Reg. No	Total Height	Shoulder Diameter	Rim Diameter
1	A13.53.5	1.07 m	0.52 m	0.140 m
2	A13.39.2	1.11	0.53	0.160
3	A13.29.1	1.01	0.50	0.155
4	A13.29.3	1.07	0.56	0.155
5	A13.29.2	?	0.51	0.150
6	A13.58.1	?	?	0.160
7	A13.30.1	?	?	0.150
8	A13.58.3	?	?	0.140
9	unreg/partial body and base			
10	unreg/base			
11	A13.23.5			0.180

The pithoi that have been reconstructed from rim to base average c. 1.06 m tall, with a diameter of c. 50 cm at the shoulder, and a diameter of c. 15 cm at the rim. Comparable pithos rims are numerous at Tall al-'Umayrī from late Iron Age II phases (Geraty *et al.* 1989: FIGS. 19.4:1; 19.12:9,11,12; Geraty *et al.* 1992: FIGS. 3.19:1,2; 3.29:1; 8.12:2,3; 8.13:1,2,3; 8.13:4,5,6) although the rim styles show some modification probably due to minor changes over time. Few close parallels in form and style from other Iron Age II sites are published to date.

Of the vessels illustrated by Franken, only two large jars (75-85 cm tall) from Phase A at Dayr 'Allā (Franken 1969: FIG. 47:1) come close in size to the Tall Jāwa pithoi. These were both collared-rim store jars from the early Iron Age I. Comparable collared-rim jars from Saḥāb are even closer in size to the Tall Jāwa pithoi measuring 1.2 m tall (Ibrahim 1978: FIG. 1).

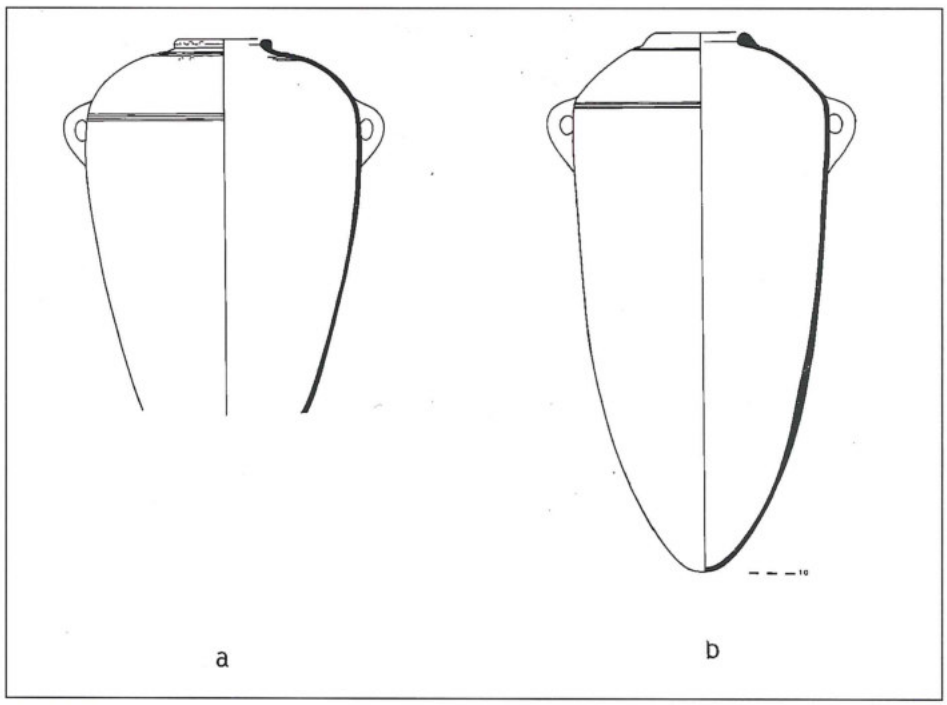
Kalsbeek did not discuss the construction techniques employed in the formation of such large vessels. Instead, he described the formation of a store jar that did not exceed 60-65 cm in height (Franken 1969: 161-262; FIG. 42). These vessels were ridged-neck jars with a broad, almost flat base that date to the late Iron Age I (1969 FIG. 62:30; and jugs[5] 60:34; 76:2). In body shape, they are very similar to a group of ridged-neck store jars from Tall Jāwa that measure c. 50-55 cm (A14.58.4;



1. Reconstructed pithoi from Field A: a. Pithos 1 (A13.53.5); b. Pithos 3 (A 13.29.1).

[4] The pithoi from Tall Jāwa were reconstructed by students employed under the Ontario Work Study Program. The students involved were Margaret Judd, Doriann Mclean, Brenda Silver, and Shawn Standfast. For this study, Laurie Cowell, a professional potter from Waterloo, ON, Canada served as consultant. This research was funded in part by an Initiatory Grant from Wilfrid Laurier University. The author's participation in the Fifth International Conference on the History and Archaeology of Jordan was generously supported by travel grant from Wilfrid Laurier University.

[5] Franken has identified both of these vessels (1969: FIGS. 60:34, 76:2) as jugs although he shows them with two handles, comparable in fact to Jar F 453 (1969: FIG. 62:30).



2. Reconstructed pithoi from Field A, showing two styles of rim, a. upright = Pithos 4 (A13.39.3); b. inverted = Pithos 2 (A13.39.2).

A14.59.1).[6] While much that Franken and Kalsbeek have said concerning the methods employed in the construction of coil-built store jars is useful for our study of the Tall Jāwa pithoi, the evidence from the pithoi themselves reflects a complex series of formation techniques somewhat different from those in use at Dayr 'Allā.

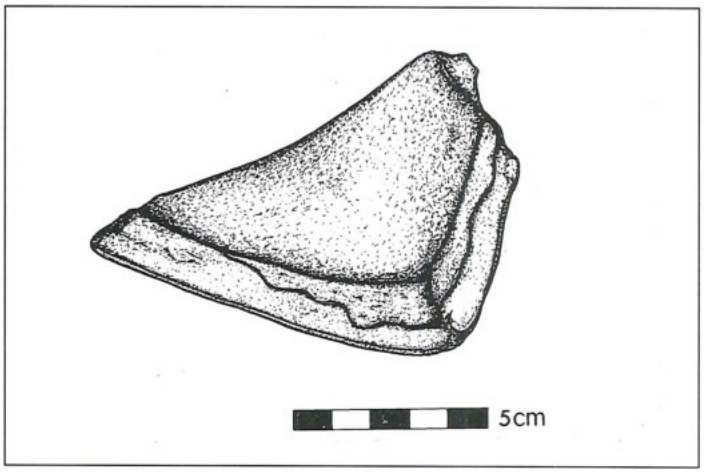
Construction Details

The initial stage of analysis of the Tall Jāwa pithoi consisted of visual observations made under magnification along with modern reproduction of certain vessel features observed during analysis.[7] The finished Iron Age pithoi reflect a complex forming process that included at least three distinct techniques, one for each of the major parts of the vessel: the base, the body, and shoulder to rim.

The evidence for the formation techniques that the Tall Jāwa potters used in the manufacture of pithoi can be pieced together from the total corpus of vessels under consideration. At the same time, this evidence is not univocal because the final finishing on the part of the ancient potter has obscured many aspects of those techniques or made the evidence ambiguous (Rice 1987: 124).

The Base

Beginning with the base, the potter may have used a disk or slab of clay that he smoothed into a shallow concave mould. In some cases the base was not sufficiently thick, so the potter added a second slab or smear of clay, visible in section in Pithoi 1, 9 and 10 (FIG. 3). The potter then turned the base on a wheel while smoothing and compressing the clay slabs together. While we may assume like Franken (1969: 89) that the Iron Age pottery was formed on a slow wheel turned by hand, the spiral marks in the base of Pithos 4 produced a central thickening that occurs only when a vessel is turned on a



3. Sherd with interior smear to thicken the base (Pithos 9, A13 unregistered).

[6] Although excavated from an adjoining room in 1991, these jars were part of the same FP-5-4 complex as the pithoi.

[7] Experimental reproduction of formation processes were carried out by Laurie Cowell at the Near Eastern Archaeology Laboratory at Wilfrid Laurier University. Attempts to arrange for xeroradiography of selected sherds to test the validity of our analysis presented in this paper are currently under way.

wheel, thus confirming our assumption (Pithoi 1, 9 and 10).[8]

Two techniques for finishing the interior of the base are evident. In Pithos 8, the potter finished the base with his thumb while turning the wheel slowly. These marks are very irregular and end where the first coil was joined to the base. From this point on in Pithos 8, the potter used a tool to make a very smooth interior surface. The second technique is apparent in Pithos 10 where the potter used a tool to smooth the centre of the base and continued smoothing the lower coils all in one operation. For this to be successful, the potter would have needed an assistant to turn his wheel.

Several bases (Pithoi 8, 9, 10) are the same size and have a small irregularity on the exterior surface below the point where the lowest coil was attached. At the same time, this irregularity does not seem to result from the final finishing on the outside of the lower body of the vessel. Such a pattern may be evidence for the use of the same mould to construct several pithoi.

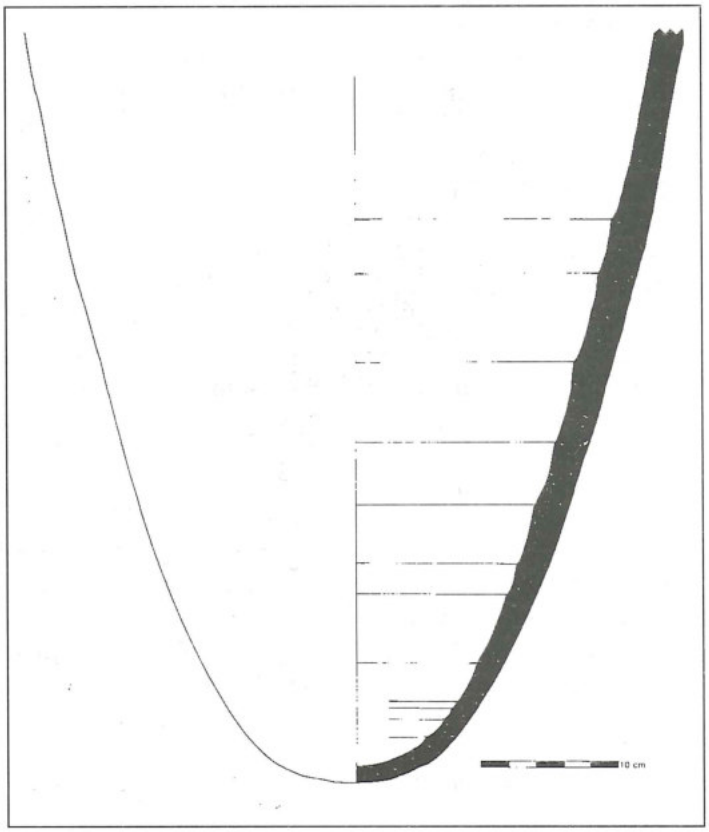
The addition of the first coil is usually perceptible on the interior immediately above the base (Pithoi 2 and 8) as Franken also observed for the Dayr 'Allā store jars (1969: 161). At Tall Jāwa, the potter worked the clay together and smoothed the upper edge of the base to the lowest coil on the interior with a finishing tool.

We have no evidence so far that could be used to support a different interpretation of the treatment of the base, for example the addition of a slab of clay to plug the base after the body had been formed or the use of the lowest coil to close the base once the vessel was removed from the wheel. Both of these suggestions assume that the vessel was inverted at some point in the formation process as illustrated by Kalsbeek for medium sized store jars (c. 60-70 cm; Franken 1969: FIG. 42). In the case of the Tall Jāwa pithoi, the potter most likely produced the finishing marks on the interior of the base and on the lowest coils while this section of the vessel was easily accessible. Secondly, because of the size and weight of the pithoi, it seems unlikely that the vessels were inverted at any time during their construction. As the pot grew, the potter supported the vessel in its mould with extra clay and did not trim the exterior face of the lowest coils above the base until the vessel was complete. While this may have helped to support the pithos and keep it centred on the wheel, the extra clay added significantly to the weight of the pot and necessitated the help of an assistant to turn the wheel as needed.

The Body

The body was built up of coils of clay attached to the preformed base and thinned to the desired thickness. These coils began just above the base and continued up to the shoulder line. The potter probably added coils in several stages so that a given number of coils could be finished on the interior before the vessel became too deep. The number of coils used cannot now be determined either by observation of the surface or in section because the steps in the process of joining the coils and finishing the pot have erased the evidence of the earlier stages of construction (Rice 1987: 124-125). One fracture that may have formed during firing is visible near the base of Pithos 4 indicating the join of two coils. However, this is a unique occurrence because the ancient potters worked the coils together so well that the sherds from these smashed vessels form vertical and diagonal lines when reconstructed and do not follow the horizontal divisions of the coils.

Soft ridges on the interior body of Pithos 3 show clearly that a large rib was used to smooth the coils and compact the clay (FIG. 4). The greatest extent between two ridges is 3.5-4.0 cm suggesting the use of a tool that was somewhat longer, comparing favourably with those illustrated by Dornemann (1983 FIGS. 85:3A; 86: 1, 2) which measure 8.5-10.0 cm and have a straight rubbing edge of 5.0-6.5 cm depending on the amount of curvature of the rib. These tools are similar to modern pot-



4. Thick-walled pithos with deep tool marks (A13.29.1).

[8] The finger marks on the interior of the base of Pithos 8 are less regular and sugges a slowly turned wheel.

ters tools where a rib of 10 cm is not unusual. The fact that these ridges are visible in Pithos 3, the vessel with the thickest walls (c. 2.5 cm), may be explained by supposing that the potter used greater pressure against the wall of the pithos because the original joining of the coils was irregular and somewhat crude. Secondly, the potter who made this vessel may have been less experienced than his fellow potters and had not thinned the coils sufficiently. Another variable may have been the speed at which the assistant turned the wheel.

The interior of the remaining pithoi also indicate the use of a tool or cloth to smooth the coils, although in these cases the potters were able to eliminate the ridges marking the extent of the tool's surface. This was done by using less pressure than was necessary to shape the body of Pithos 3. Thus the interior of Pithoi 1, 2, 4 and 5 do not have ridges but fine spiraling rill marks that produced a very smooth finish. At the same time, these vessels were thin-walled (c. 1.5 cm) in comparison to Pithos 3.

The first series of coils had to become leather-hard before the potter applied additional coils. For large jars the drying period may have been as much as one day[9] although in the climate of the Jordanian plateau this may have only taken a few hours.[10] The point at which the second series of coils was added or the point at which the potter began a second stage of interior smoothing, is recognizable in certain vessels, for example in Pithos 3 there was an interruption in the spirals c. 30 cm above the base. This suggests that the body of the pithos, from base to shoulder, was probably built in two sections, each about 30-35 cm high.

The coils of the upper part of the body were thinned and smoothed on both the interior and exterior surfaces. The type of tool used to finish the exterior is not apparent from the appearance of the surface although the same kind of rib used on the interior of the vessel or a cloth may have been employed. The care in joining the coils to one another is especially apparent in the shoulder area.

Shoulder and Rim

The shoulder and rim appear to have been formed while the pithos was being turned quickly on the wheel by an assistant. The rill marks (Rice 1987: 129) of the potter's fingers are quite clear on the inner surface of the largest vessels (Pithos 4). Those that are somewhat smaller (Pithos 8, and even Pithos 1) show signs of a fast turning wheel. No finger marks appear on the outer surface indicating that the potter smoothed the shoulder area with a tool or a rag. The possibility that the shoulder and rim section was made separate from the lower body cannot be seriously considered because of the smooth continuation of the vessel wall from the body into the shoulder area. Here too, the size of individual coils cannot be determined although it seems certain that the entire vessel was coil-built.

The clay of the uppermost coil was then pulled to form a folded rim which can be seen in section. These rims were quite heavy for the width of the vessel wall at the shoulder. In one instance (Pithos 1), the weight of the rim caused the shoulder to warp.[11] Decoration consisted of a double ridge at the base of the rim and a double "string line"at the join of the body to the shoulder. This line marked the horizontal at a point where there was a change of direction. In order for these lines to be horizontal, the potter had to etch them with a tool while the jar was revolving on the wheel. The lines do not seem to reflect the use of string on the vessel for support or decoration as Franken suggests (1969: 162).

The top of the handles were attached to the body at the shoulder and covered the horizontal lines. The shafts of the handles were then pulled from that point and attached lower down on the body. As Franken observed in his corpus, the upper part of the handle was usually broader than the lower end where it was pressed onto the wall of the jar (1969: 170-171). For greater strength, a small coil of clay was added around the base of the handle (TJ A13.unreg. handle; see London 1990: FIG. 52).

Finishing

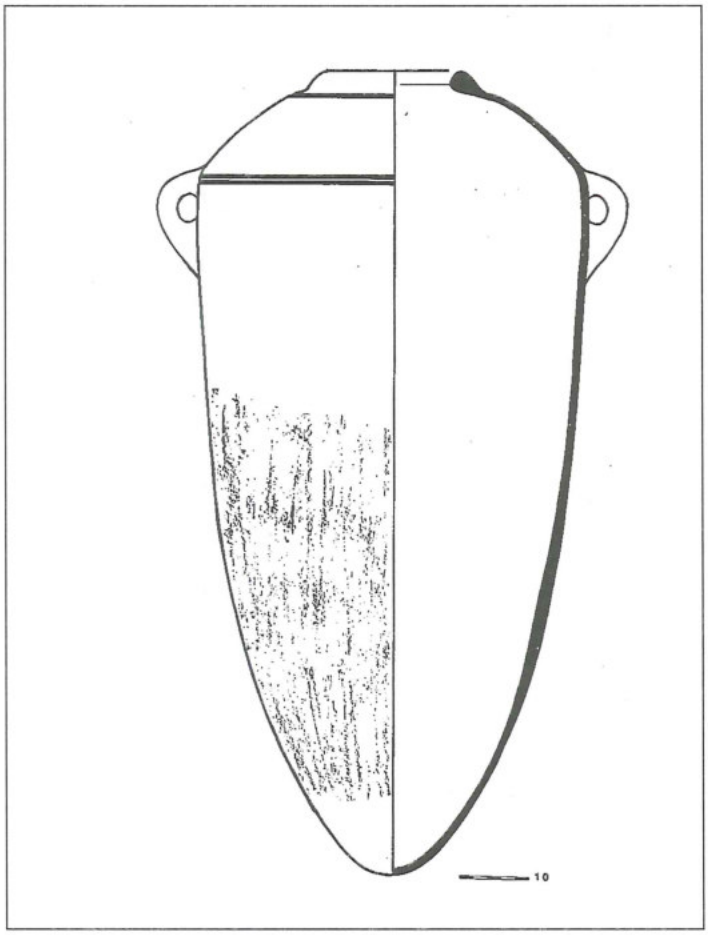
After the handles were added and the vessel was complete, it was allowed to dry to the leather-hard stage. It was probably at this point in the process that the pithos was turned upside down and rested on its shoulders. Then the excess clay was trimmed from the outer side of the coils. During the trimming process, the potter no longer could judge the thickness of the walls of the jar with the result that their thickness was very uneven. In some cases the walls were almost paper thin (especially Pithos 4). Vertical tool marks remaining on the area that was trimmed can be clearly seen extending from the middle of the body, c. 20 cm below the handles, to just above the base for a total of 40-50 cm (FIG. 5).

Another feature of these pithoi are the holes punched or cut into the side of the body. This phenomenon is observed in at least three of the jars (Pithoi 1, 4, 5). All

9 For a discussion of the techniques employed by Spanish potters who manufacture extra large storage vessels that reach almost 4 m in height, see below.

10 During the summer of 1991, Nazmieh Rida Tawfiq Darwish constructed a clay oven *(ṭābūn)* in 'Ammān. The oven was coil built and required approximately one hour to dry before an additional coil could be applied. This is evidence of the hot, dry climate on the Transjordanian plateau that lies at an elevation of c. 928 m above sea level. To my knowledge, no consideration has been given to the difference in climatic conditions between the Jordan Valley and the plateau region in evaluating the time needed for ceramic vessels to dry before burnishing or firing.

11 The shoulder of the pithos was probably formed while the clay was quite wet and supple. With the addition of the thickened rim the shoulder would be under stress and might slump inward as was the case for Pithos 1.



5. Pithos 2 with trimmed side walls (A13.39.2).

holes were formed from the outside to the inside where a compound fracture is apparent. In Pithos 1 there are two holes 8 cm apart and c. 25 cm below the shoulder. They were positioned on one side of the vessel, slightly off centre between the handles. In Pithos 4 the holes were 33 cm below the shoulder and in Pithos 5 the holes were very close to the base at 60 cm below the shoulder. The function of this feature is uncertain although it was clearly related to the function of the vessels themselves (Henrickson and McDonald 1983: 631-636; Rice 1987: 224-225). The ancient potters certainly made these large jars to contain liquid rather than dry ingredients. The size of the mouth opening is so small and the vessels are so deep that it would have been almost impossible to scoop out dry foods such as chick peas, lentils or grain from such containers. On the other hand, the pithoi may have contained a liquid such as wine that formed a sediment below the level of the holes.

Potter's Marks

One complete vessel (Pithos 4) and two partial rim and shoulder sections have potter's or owner's marks. The only complete mark, formed before firing, consists of five reed impressions, three on the rim and two on the shoulder (Pithos 4; see also Rice 1987: FIG. 5.15). A second impression, also before firing, is only partially preserved on a large sherd forming the rim and shoulder of a pithos (A13.23.5, Pithos 11). The mark consists of a single reed impression with a tail extending down and to the right. At this point the sherd is broken. The third mark was incised after the jar was fired. It consists of three parallel vertical lines resting on a single horizontal line (Pithos 6; FIG. 6).

Ethnographic Parallels

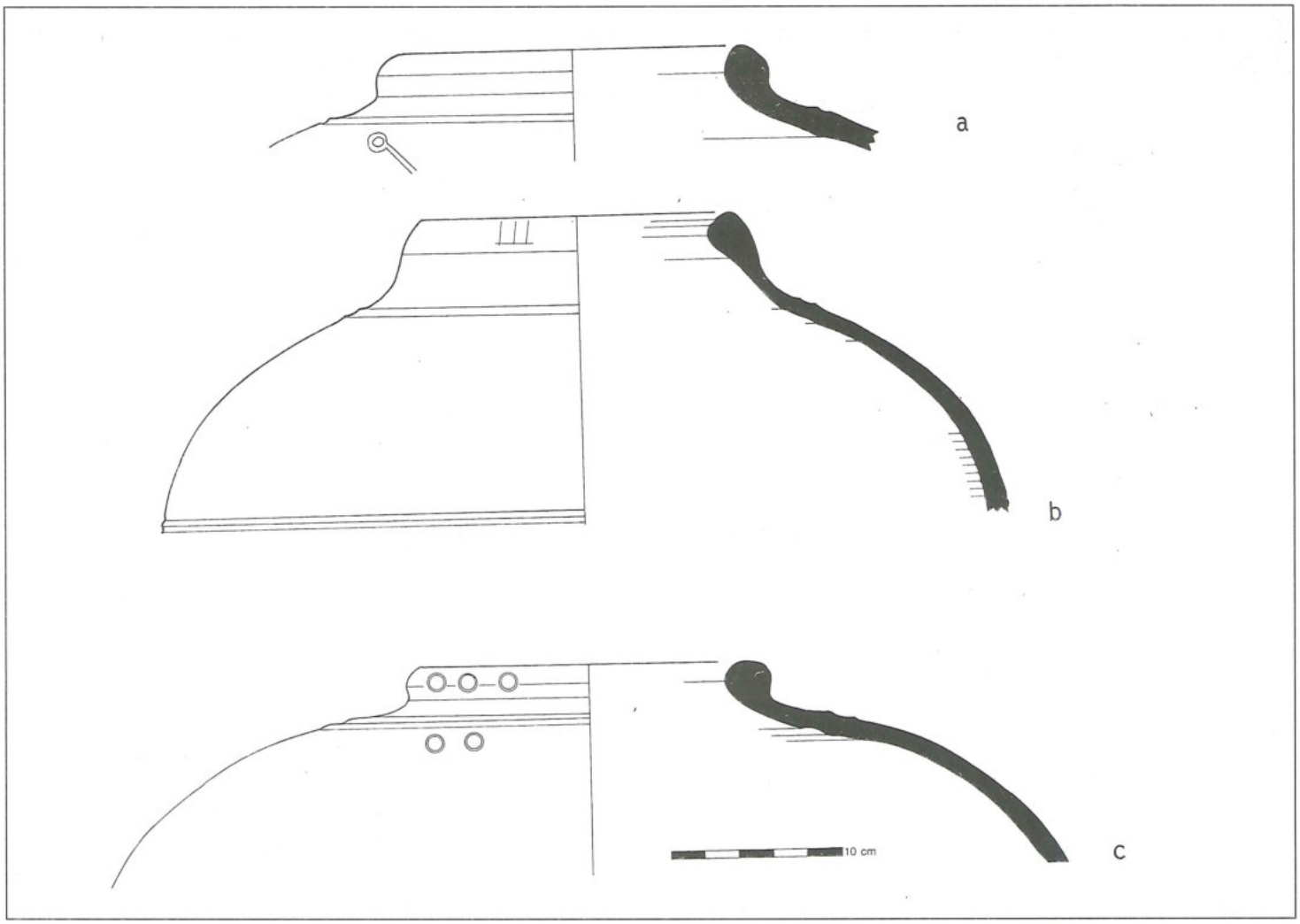
Several aspects of the construction of the Tall Jāwa pithoi appear to be problematic in that they do not follow the techniques suggested by Franken and Kalsbeek. In order to support our interpretation of the evidence from the vessels themselves, a survey of parallels from traditional potters has been assembled from ethnographic literature.

Four sources that deal with the construction of pithoi or large jars come from Spain (Cabasa 1990), Crete (Flodin-Moreno 1980),[12] Cyprus (London 1990), and Pakistan (Rye and Evans 1976).

The production of *pitharia* on Crete and in Cyprus are attempts to reproduce forms that have a long tradition in these respective islands. Models from the archaeological record dating to the Middle and Late Bronze Ages have been preserved at Knossos, where they functioned as storage containers for water, oil or wine (Flodin-Moreno 1980: 51). The modern production of comparable containers involves the use of a hand turned wheel to "throw" these coil-built vessels. Each vessel has a flat base formed from a thick slab of clay. Coils are added to the base and the join between coils is marked by a string to indicate the juncture where later decoration will be located. The lower body is cylindrical and then flares out until it reaches the maximum body diameter. These *pitharia* are wide-mouth vessels with a horizontal thickened rim.

Several of the construction techniques employed in forming the Cretan *pitharia* seem to parallel those we suggest were used in the production of the Tall Jāwa pithoi. First, the *pitharia* were formed on a wheel that was turned continuously during construction. Secondly, the thick coils were added, one at a time, and left to set up before another was added. At no time during the formation process was the vessel inverted. Only at the time of stacking in the kiln were some vessels positioned upside down over others that remained right side up. And thirdly, the string marks appear to be locators for decoration rather than functionally important.

[12] An earlier example of modern potters producing vessels similar to those made on Crete in antiquity was observed by Xanthoudides, cited in Wood (1990: 37).



6. Potter's marks on rims; a. Pithos 11 (A13.23.5), b. Pithos 6 (A13.58.1), c. Pithos 4 (A13.29.3).

Details of construction and finishing reported for the *tinajas* made in Spain add to our understanding of the work involved in making large jars. These coil-built vessels are formed on a clay or wooden bat beginning with the base which is made from a long coil (5'=1.5 m long) that is draped over the shoulder of the potter while he works. The lower body is then shaped in the form of a cylinder and left to dry before additional coils are added (Cabasa 1990: 47). When sufficiently dry, the vessel is scraped with the fingers and with a metal scraper to compress and finish the lower body. Then another coil is added, the body expanded, and the process repeated. When the vessels become taller than 1.5 m, a scaffold is built so that the potter can continue to enlarge the vessel. The largest vessels of this type reached c. 4 m tall, with a capacity of 8000 litres, and required 2 tonnes of clay (Cabasa 1990: 47). For the most part, the potter was required to walk around the *tinaja* while applying a coil of clay, although in some cases the lower body was formed on a hand wheel (Cabasa 1990: 48).

Here we have another case where a vessel is completely formed in an upright position and is finished in stages as the jar gets taller. There is no suggestion that the Spanish potters used string, rags or rope around the body for support as was depicted by London in her study of Cypriot potters who produced much smaller vessels (1990: FIGS. 50-57, 71).[13] This technique appears to be the continuation of a traditional practice rather than a technical necessity. For this reason, and because no evidence for such treatment is preserved on the Tall Jāwa pithoi, we suggested that the so-called "string marks" were decoration applied by the potter using a tool while each vessel was turned on the wheel.

The largest vessel that London documented on Cy-

[13] What the precise purpose was of the string or rags around the lower part of these vessels remains unclear. The vessels appear to be only 25-30 cm tall and do not really need support for the clay unless it is very thin. Even so, the pressure of the string would either cut the clay or cause it to collapse inward. It is almost unimaginable that hand built jars or jugs would be likely to warp or collapse or that the string would prevent this if, in fact, the clay slumped.

prus was a coil-built flower pot that was formed in an upright position on a flat surface. In this case, like the *pitharia*, the potter had to walk around the vessel when adding new coils. A cane hoop was used to measure the greatest diameter and maintain symmetry (London 1990: FIG. 31). Only after the vessel was complete and partially dry was it inverted and the base scraped and trimmed of excess clay (London 1990: 62).

Another large vessel in the repertoire of the Cypriot potters was a clay oven in the shape of a large jar with a wide mouth. This vessel was built in a similar fashion to the flower pot. London judged that it was too heavy to be built on a turn table and that the potter walked around the oven when adding new coils. When this vessel is compared with the Cretan *pitharia* that were formed in their entirety on the wheel (Flodin-Moreno 1980: FIG. 8), weight does not seem to be a real issue. It is possible that the Cypriot potters used an entirely different type of potter's wheel that could not support a large vessel, although this cannot be determined from the published illustrations.

In very few instances do ethnographers document the actual appearance of the vessel's interior or the types of smoothing tools used for its finishing. Did potters use their fingers to compact and smooth the base? What is the appearance of the join between the base and the first coil? Is there any evidence for the use of a mould and what does that evidence look like?

The only ethnographic study known to this writer which describes the formation of large jars (c. 1 m tall) in a mould is the "Ethnotechnology of South Asia Research Program" in Pakistan reported by Rye and Evans. Water jars made in Musazi, a village 11 km southeast of Peshawar, were coil-built with the base being formed in a mould. The mould was concave and positioned on the wheel head before any clay was added. Then the potter formed a flat disk of clay and laid it in the mould. He then smoothed the clay into the mould and added the lowest coil, throwing it to form the wall of the jar (1976: 33, FIG. 24).

No time for drying was left before the next coil was added.[14] The formation process was the result of throwing the jar on the wheel and did not incorporate the use of a paddle or anvil to beat out the shape of the jar as with smaller vessels, except on the upper part of the jar after it became leather-hard. Clearly, the base was finished as soon as it was placed in the mould because the addition of coils and the throwing of the walls of the jar made further smoothing of the interior impossible. In fact, the jar was left in the mould until it was completely polished and decorated. Only at this point is the vessel removed from the mould and inverted to continue drying. When the jar is sufficiently dry, the potter scraped the base to remove the excess clay at the join of the base and the lowest coil (Rye and Evans 1976: 33-34).

This study answers several of our questions while suggesting others. It is now clear that a jar of approximately 1 m in height can be formed on a wheel in a base mould. At the same time, the jars made at Musazi were cylindrical, facilitating the use of a dish-shaped mould. By comparison, the Tall Jāwa pithoi have a tapered base making it more difficult for the potter to centre the mould on the wheel head and keep it balanced. However, the body of these Iron Age pithoi are strikingly cylindrical, suggesting that the lower part of the body was supported on the wheel by the addition of clay that was later scraped away. This was only done when the pithos was finished and sufficiently dry to be inverted and rest on its rim or shoulder. Because of the final finishing of the pithoi, some aspects of the formation process must remain unknown. However, the potters of Pakistan provide an image of what may have been possible at Tall Jāwa in the Iron Age.

Conclusions

The Tall Jāwa pithoi were coil-built vessels constructed on a wheel in an upright position. Finger marks inside the shoulder suggest that during the formation process the vessel was "thrown." At least by the ninth century BC in the Madaba Plains region, coil-built vessels turned on a wheel are contemporary with red slipped vessels and wheel burnished bowls (see note 2). This use of the wheel corresponds to Franken's research at Jordan Valley sites which suggests that the wheel was reintroduced during Iron Age II after a lapse in its use during Iron Age I (1969: 92). Subsequent study by McGovern confirms the use of a true potter's wheel for Late Bronze Age I (1986: 173) and suggests formation processes comparable to those used at Dayr 'Allā for both the Late Bronze and Iron Age I. However, large store jars comparable to those from Tall Jāwa were not present in McGovern's corpus and the collared-rimmed jars from both Saḥāb and Tall al-'Umāyrī have not yet been studied and will probably reflect the Iron Age I traditions[15] rather than the techniques that developed during Iron Age II. Therefore the evidence from the Tall Jāwa pithoi may provide our first glimpse of these developments.

The complex construction techniques employed in the formation of the pithoi from Tall Jāwa may be seen to constitute a pot making tradition of the Ammonite plateau during the ninth-eighth centuries BC. Evidence for the use of these techniques at other sites or of alternate

[14] See note 10 above.

[15] To the best of this writer's knowledge, the technical characteristics of these jars have not yet been studied.

techniques will enable archaeologists to determine the spatial diffusion of the Tall Jāwa tradition on the Transjordanian plateau (Wood 1990: 58). Such comparison will supplement other types of ceramic analysis that study the physical properties of the clay and its sources,[16] the distribution of ceramic styles, as well as functional and typological analysis.

I would like to dedicate this paper to the memory of Prof. Albert E. Glock whose interest in ceramic technology and ethnographic observation should not be forgotten.

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[16] To date, no comparison of the chemical profile of clay samples and local ceramics has been undertaken for the Madaba Plains area comparable to that for Jordan Valley sites, such as Tall al-Ḥayyāt (Falconer 1987: 251-259), and for the Baq'ah Valley region (McGovern 1986: 178-193). A preliminary analysis of the petrographic characteristics of the pottery sherds from the Madaba Plains Project area (London *et al.* 1991) included cooking pots from Iron Age II loci.

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